Subcategories for Boilers Firing Wood, Non-Fossil Materials, and Coal

History:

- At the February Boiler WG meeting, EPA presented preliminary subcategory assignments.
- Based on comments from the WG at subsequent meetings, the subcategories were revised. In most cases, subcategories were combined to reduce the total number of subcategories within each subgroup.

Current Status:

- Table III-1 presents the revised subcategories for the fossil, wood, and non-fossil subgroups.
- Also attached to this work in progress is: (1) a fact sheet for a Section 112 biomass subcategory, (2) the rationale for a Section 112 biomass subcategory, (3) two memos containing comments from a Work Group member on the Section 112 biomass subcategory rationale and fact sheet, and (4) rationale for the non-fossil subcategories.

Notes:

- Fossil fuel subcategories are divided first into solid fuels, liquid fuels, and gaseous fuels. The solid fuels are further divided by firing type and specific fuel types. The solid fuel types were divided because some coals have high moisture and high ash contents while others have low moisture and ash contents. Fossil fuel boilers in the ICCR inventory database were assigned to a subcategory using a hierarchy for co-fired boilers. The gas subcategory (gas is defined as natural gas, LPG, or propane) contains gas-fired boilers and gas/distillate oil co-fired boilers because most of these co-fired units only burn a small percentage of distillate oil as a secondary fuel. The distillate oil subcategory contains boilers firing only distillate oil. The residual oil subcategory contains boilers firing only residual oil or residual oil boilers co-fired with gas or distillate oil. Co-fired coal boilers were assigned to subcategories based on the ‘dirtiest’ fuel burned (petroleum coke being the dirtiest and anthracite the cleanest).
- Boilers in the ICR survey database were assigned to the wood subcategories by first identifying the majority fuel (i.e., >50% input). If a boiler burned both timber and dry wood and the percentages were such that neither dry wood nor timber was the majority of the fuel input, the boiler was assigned to the timber subcategory. A boiler burning any percentage of treated wood was assigned to the treated wood subcategory. Wood-fired boilers were divided into dry wood and timber products subcategories because moisture in the wood affects boiler design, emissions from their combustion, and control devices

necessary to reduce these emissions. Most treated wood boilers are fired with Section 129 fuels and produce significantly different emissions than dry wood and timber-fired boilers.

- The non-fossil subcategories are based on a fuel being burned >70%. Boilers burning any amount of a potential Section 129 material were assigned to the Section 129 mixed feed subcategories. If all fuels burned were Section 112 fuels (but there was not >70% of any one type burned), the boiler was assigned to the Section 112 mixed feed subcategory.

Table III-1. Current Subcategories for Boilers

Fossil Fuel	Wood	Non-fossil
Gas	Dry wood products	Gas fossil or non-fossil fuel & other gases
Unheated liquids (distillate oil)	Timber products	Gas fossil fuel & other non-fossil solids or liquids
Heated liquids (residual oil)	Treated wood	Liquid fossil fuel & other non-fossil solids or liquids
Solids - pulverized coal/cyclone firing petroleum coke		Bagasse
Solids - pulverized coal/cyclone firing anthracite coal		Biomass
Solids - pulverized coal/cyclone firing bituminous coal		Solid fossil fuel & other non-fossil (stoker boiler)
Solids - pulverized coal/cyclone firing subbituminous coal		Solid fossil fuel & other non-fossil (pulverized coal boiler)
Solids - pulverized coal/cyclone firing lignite coal		Solid fossil fuel & other non fossil (other boiler)
Solids - mass-feed firing anthracite coal		Section 112 wood & other non-fossil
Solids - mass-feed firing bituminous coal		Section 112 mixed feed (no material above 70%)
Solids - mass-feed firing subbituminous coal		Section 129 mixed feed solids
Solids - mass-feed firing lignite coal		Section 129 mixed feed liquids
Solids - fluidized bed firing petroleum coke		
Solids - fluidized bed firing anthracite coal		
Solids - fluidized bed firing bituminous coal		
Solids - fluidized bed firing subbituminous coal		
Solids - fluidized bed firing lignite coal		

[a] Subcategories based on greater than 70% of a material (or material listed first if a combination)

Fact Sheet for 112 Biomass Subcategory

SUBCATEGORY NAME: Biomass

ASSIGNED CAA SECTION: 112

GROUPINGS WITHIN SUBCATEGORY: Industrial, Commercial, and Institutional Steam Generating Units of the following size groupings: 0-10 MMBTU/hr, 11-50 MMBTU/hr , 51-100 MMBTU/hr, and >100 MMBTU/hr, and by materials combusted and/or by type of combustor.

POPULATON STATISTICS:

MATERIAL COMBUSTED:

Untreated wood and wood products (e.g., trees, tree stumps, tree limbs, bark, lumber, sawdust, sanderdust, chips, scraps, slabs, millings, shavings, pallets, forming & framing lumber, and engineered wood); vegetative agricultural and silvicultural materials, such as logging residues (slash), nut and grain hulls and chaff (e.g., almond, walnut, peanut, rice, wheat), bagasse, orchard prunings, corn stalks, coffee beans hulls and grounds, and alcohol fuels derived from these materials. Biomass does not include: painted, pigment-stained (with the exception of those materials applied with coatings subject to the requirements of 40CFR63), or pressure treated materials (e.g., telephone poles, railroad ties); sewage sludge, paper mill sludge, fermentation tank bottoms, or other sludges; or construction, renovation, and demolition wastes. Pressure treating compounds include, but are not limited to, chromate copper arsenate, pentachlorophenol, and creosote.

COMBUSTION DEVICE: Includes single and multi-chamber and fluidized bed boilers of various sizes.

BASIS FOR SUBCATEGORY BOUNDS:

POLLUTANTS CONSIDERED FOR REGULATION: Section 112 Pollutants

FLOOR LEVEL OF CONTROL:

A review of the Wood Boiler emissions databases and the general literature clearly demonstrates that metal emissions from wood boilers are both very low and easily controlled with good particulate control. Clearly, no additional pollution control equipment is required for control of HAPS Metals beyond Particulate Matter control. Likewise, any organic emissions are very low and can be controlled by attention to maintaining good combustion. Therefore, MACT Floor for the Section 112 Biomass subcategory is based upon Particulate Matter Control (PM) for HAPS Metals and Good Combustion Practices for HAPS Organic Emissions.

The degree of PM Control should be based upon a review of the emissions limitations achieved by the top 12% best performing units in each grouping. The definition of Good Combustion Practice (GCP) for each grouping should be based upon a review of the practices that are available and practicable for each grouping based on those practices used by the operators of units which represent the top 12% best performing units in each grouping.

For Organic HAPS, the determination of the top 12% best performing units in each grouping should be

based upon organic or Carbon Monoxide emissions limitations achieved by those units. If there is insufficient emissions limitation data available upon which to judge the top 12%, then standard industry practices for good combustion should be considered.

REGULATORY ALTERNATIVES ABOVE THE FLOOR:

STATUS OF DATA COLLECTION AND ANALYSIS:

There is sufficient emissions limitations data, i.e., permit limits, for PM, CO, and Organic HAPS, for the Wood-fired boilers in the ICCR Inventory to determine the MACT Floor. However, this data is currently not in a form that is useful. USEPA should convert the inventory data into a common concentration basis such as gr/dscf corrected to a standard Oxygen (for PM), lb/MBTU of heat input, ppmdv corrected to a standard Oxygen, or mg/dscm corrected to a standard Oxygen. This data can then be used to determine the top 12% of the units and the MACT Floor.

ISSUES AND NEEDS:

OTHER COMMENTS:

Rationale for the Subcategory Definition for Biomass-fired Boilers under Section 112 of the Clean Air Act

1.0 INTRODUCTION

The Wood Subgroup (WSG) of the Boiler Working Group (BWG) of the Industrial Combustion Coordinated Rulemaking (ICCR) has prepared this Subcategory Definition for review by the BWG for submission to the ICCR Coordinating Committee (CC).

This Subcategory Definition contains recommendations regarding categories of boilers considered for regulation under Section 112 of the Clean Air Act, the pollutants to be regulated, and a floor level of control. Additionally, the Subcategory Definition contains other relevant subcategory-specific information such as, combustion device descriptions, the status of data collection and analysis, and issues and needs. Unfortunately, the ICCR Boiler Inventory is not sufficiently detailed to determine the exact subcategory population statistics.

This Subcategory Definition has been developed for Biomass-fired boilers. This Subcategory includes "clean" wood as well as other biomass as defined within the Subcategory Characterizations section of the Subcategory Definition.

2.0 BACKGROUND

Currently, EPA has not fully developed a final definition of *solid waste* for purposes of Section 129 of the Clean Air Act. EPA has indicated that boilers that combust biomass and "clean" wood would be subject to regulation under Section 112, and boilers that combust nonhazardous solid waste should be considered "solid waste incineration units" under Section 129. Therefore, the WSG has suggested a placeholder for the "Treated/Waste" Wood subcategory for potential regulation under Section 129. The number and description of Treated/Waste Wood subcategories that may ultimately be addressed under Section 129 remains uncertain at this time.

Since EPA has indicated that "clean" wood and biomass-fired boilers may be regulated under Section 112, the definition of *solid waste* is not as crucial to this Subcategory Definition.

In developing this Subcategory Definition, the WSG reviewed the ICCR databases for wood and biomass-fired boilers, reviewed emissions data from wood and other biomass-fired facilities, and thoroughly investigated potential HAPs pollutants of which might be of concern and, therefore, would need to be considered for regulation. Based upon this work the WSG developed the recommendations for subcategory definitions, pollutants to be regulated, and control level floors that are presented in this Subcategory Definition document.

While the exact number of facilities subject to this Subcategory Definition is unknown, it has been estimated that the annual amount of wood potentially available for combustion as a fuel is in excess of 36 million tons[1]. This does not include the biomass component of this Subcategory such as bagasse, rice hulls, etc.

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[1] Wood Products in the Waste Stream -- Characterization and Combustion Emissions, Volume 1, Technical Report, Environmental Risk Limited, US EPA Air and Energy Engineering Research Laboratory, Research Triangle Park, NC 1996

3.0 SUBCATEGORY CHARACTERIZATIONS

The boiler units that are represented in this Subcategory Definition range in size from very small boilers (e.g., 10 MMBtu/hr) to very large (>250 MMBtu/hr per boiler). The smaller units are most often located at a manufacturing facility such as a furniture manufacturer and provide process steam for drying wood products. The larger units are usually found as stand-alone independent electric power generating units, at larger wood mills, or at pulp and paper facilities.

The type of boilers include cell burners, Dutch ovens, various grate burning systems (spreader stokers with either fixed or traveling grates, underfeed stokers, and inclined grates), suspension burners, and fluidized bed combustion units.

Fuels combusted under the Biomass Subcategory include untreated wood and wood products (e.g., trees, tree stumps, tree limbs, bark, lumber, sawdust, sanderdust, chips, scraps, slabs, millings, shavings, pallets, forming & framing lumber, and engineered wood); vegetative agricultural and silvicultural materials, such as logging residues (slash), nut and grain hulls and chaff (e.g., almond, walnut, peanut, rice, wheat), bagasse, orchard prunings, corn stalks, coffee beans hulls and grounds, and alcohol fuels derived from these materials. Biomass does not include: painted, pigment-stained (with the exception of those materials applied with coatings subject to the requirements of 40CFR63), or pressure treated materials (e.g., telephone poles, railroad ties); sewage sludge, paper mill sludge, fermentation tank bottoms, or other sludges; or construction, renovation, and demolition wastes. Pressure treating compounds include, but are not limited to, chromate copper arsenate, pentachlorophenol, and creosote.

Based on the information currently available to the WSG, it appears that most existing facilities which are subject to this Subcategory Definition have some degree of particulate controls in place. Particulate controls include cyclones, multiclones, electrostatic precipitators, wet scrubbers, fabric filter baghouses, or a combination of these.

4.0 HAPS of INTEREST

The WSG initially investigated the Section 112 list of HAPs to identify HAPs which might be considered to be present in the emissions from wood-fired boilers in sufficient quantity to warrant further consideration. To accomplish this, the WSG enlisted the aid of Richard Atkins of Environmental Risk Limited, a consulting firm with a great deal of experience in wood-fired combustion. Mr. Atkins had previous conducted to major research project on wood combustion for the New York State Energy Research and Development Agency and a similar project for US EPA's Air and Energy Engineering Research Laboratory.

Based upon the recommendations of Mr. Atkins, the WSG submitted its recommendations of HAPs of Interest to the BWG. While the majority of the BWG accepted the recommendations of each of the Subgroups within the BWG, a BWG minority group opinion that included additional HAPs pollutants was also presented. A committee consisting of a member of each subgroup and the minority group attempted to reach consensus through the use of a consistent objective analysis of the majority and minority groups' HAPs lists. For the Wood subcategory, it was agreed that the New Hampshire Department of Environmental Services (NHDES) would conduct dispersion modeling analyses of a "typical" small wood-fired source and a "typical" large wood-fired source. The results would then be compared to the NHDES ambient air toxics guidelines. Source emissions levels below the NHDES guideline levels would be dropped from consideration as a HAP of Interest, and source levels for HAPs above the guideline would be further evaluated.

After this analysis and another analysis using more realistic modeling and source parameters, the Wood subcategory HAPs list was subjected to the NHDES guidelines as well as the Florida air toxics guidelines and EPA's Boiler and Industrial Furnaces (BIF) criteria. Based upon these exhaustive analyses, it was determined that none of the emissions of HAPs from wood-fired boilers would exceed a level of concern. Consequently, the WSG recommended to the BWG that there were no HAPs of Interest for "clean" wood-fired boilers.

This is consistent with the findings in the 1996 EPA report (cited above) on wood combustion which concluded:

> Organic compounds regulated as hazardous air pollutants that have been measured in detectable amounts in wood combustor flue gas include aldehydes, benzene, phenol, and polynuclear aromatic hydrocarbons (PAH). These compounds are formed as products of incomplete combustion and do not appear to be a function of wood composition or source. Instead, they appear to be correlated to emissions of carbon monoxide and total hydrocarbons, which are also indicative of combustion inefficiency. "Good" combustion conditions appear to minimize organic emissions.
>
> Metals control efficiency appears to be roughly equivalent to total particulate control efficiency with the exception of mercury.
>
> Chlorinated organic compounds, such as dioxins, furans, polychlorinated biphenyls, chlorinated phenols, and chlor-benzenes are usually measured at extremely low concentrations or were reported to be less than minimum detection limits.

It is also interesting to note that the above report found that comparison of emissions data from "clean" wood with emissions data from "treated" wood at the same source "indicate that organic emissions are generally not increased from combustion of "treated" wood." And "while metals emissions data from these sources were very limited, the data indicate only slightly higher levels for "treated" wood combustion."

5.0 POLLUTION PREVENTION

The WSG believes that pollution prevention, taking into account the feasibility, practicality, and cost-effectiveness of such measures for the various subcategories, should be considered as part of the Section 112 rulemaking for Wood and Biomass boilers.

The ICCR P^2 Committee prepared a list of possible pollution prevention items regarding good combustion/operating practices (GC/OP), operator training, and pollution prevention metrics which was submitted to the CC. The potential pollution prevention approaches identified by the P^2 Committee included the following techniques:

- Operator practices
- Maintenance knowledge and practices
- Stoichiometric ratio (air/fuel)
- Firebox residence time, temperature, and turbulence
- Fuel/waste quality, handling, sizing, dispersion, and liquid atomization
- Combustion air distribution

If appropriate, implementation of these techniques could be accomplished, for example, through a combination of documented operating and maintenance procedures, logs and record-keeping, training on equipment and

procedures, routinely scheduled inspections and maintenance, burner and control adjustments, system design, fuel/waste monitoring, and various system adjustments. Operator training could also be considered a good combustion/operating practice.

6.0 MACT FLOOR

Based upon the above analyses, it was determined that the MACT floor for biomass-fired (including "clean" wood) boilers should be particulate control for HAPs Metals and Good Combustion/Operating Practices (GC/OP) for HAPs Organic emissions. Further investigation of practical and effective combustion/operating practices applicable to this subcategory is necessary. Because of the variety of unit designs, sizes and fuels addressed by this Subcategory Definition, it may be appropriate to develop a separate set of GC/OPs for each subcategory within the Biomass subcategory. For some subcategories, no or minimal GC/OPs may be appropriate, e.g., very small boilers. On the other hand, if there are practical and effective combustion/operating practices that are the same or similar among multiple subcategories, a single set of GC/OPs for all units covered by those subcategories may be considered.

Work Group Member Comment on Fact Sheet and Rationale for Section 112 Biomass Subcategory (Memo 1)

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division
Inter-Office Communication

FROM: **Andrew M. Bodnarik**
ICCR Boiler Workgroup Member
ICCR Wood HAPs of Interest Subgroup Member

To: **Jim Eddinger, ICCR Boiler Workgroup Co-Chair**
Jim Stumbar, ICCR Boiler Workgroup Co-Chair
Frank Ferraro, Boiler Workgroup Member

Date: **August 26, 1998**

RE: **DRAFT Comments on "Rationale for the Subcategory Definition for Biomass-fired Boilers under Section 112 of the Clean Air Act**" (ICCR Boiler Workgroup Data Analyses Packet, August 17, 1998)

General Comments

The title of the paper does not accurately reflect its contents since it contains statements on several other issues beyond the issue of defining biomass boilers as a subcategory such as:
HAPs of Concern for the "Wood subcategory, Pollution Prevention for Wood & Biomass boilers, and MACT floor for "biomass-fired" (including "clean" wood) boilers. This problem is compounded by the fact that the introduction to the paper repeatedly refers to a subcategory definition without explaining to the reader that the actual subcategory definition can be found in the "subcategory template" attached to the narrative. While this type of reference is probably not required for members of the ICCR Boiler Work Group or the Wood Subgroup, it should be included to assist the members of the ICCR Coordinating Committee and other readers of the paper.

The statement on materials combusted implies that alcohol fuels derived from wood and wood products should be included under the definition of biomass. This seems inconsistent since fermentation tank bottoms are excluded. The term "alcohol fuels" is too broad and would seemingly allow any fuel containing any amount of alcohol to be classified as biomass if the alcohol portion resulted from biomass. No basis is given for the subcategory bounds. While recognizing that this paper and the subcategory template are works in progress some concept must have been used as a basis for this subcategory.

The Combustion Device description in the subcategory template fails to recognize the combustor types described in the narrative, i.e.: cell burners, Dutch ovens, various grate burning systems (spreader stoker boilers with either fixed or traveling grates, underfeed stoker boilers, and inclined grates), and suspension burners. These combustor types should be included in the subcategory template.

The subcategory template uses the term "good particulate control" without explaining how "good" is distinguished from "poor". Therefore this term is too vague. If good particulate control means an electrostatic precipitator or a fabric filter then this should be clearly stated.

The statement in the subcategory template under the section on Floor Level of Control that: "Clearly, no additional pollution control equipment is required for control of HAPs metals beyond particulate matter control" is too vague since there is a broad range of particulate matter controls which have variable control efficiencies. This statement is even weaker than the term good particulate control.

The statement in the subcategory template under the section on Floor Level of Control that: "Likewise, any organic emissions are very low and can be controlled by attention to maintaining good combustion," is at best premature. Later in the Status of Data Collection and Analysis section a statement is made that analysis of the currently available emissions limitation data was not completed by the subgroup to determine a MACT floor for organic HAPs because the data "is currently not in a form that is useful. If you have not completed the analysis of the available data then do not reach premature conclusions. In addition, this statement also fails to recognize that organic HAP emissions vary with the type of biomass combusted as well as with the type of combustor. In essence, conclusions are being made prior analyzing the currently available emissions data and other data needed to determine the Floor Level of Control.

The section on Floor Level of Control also fails to acknowledge the Boiler Workgroups recommendation for further testing. This stack test information will also be a useful supplement to currently available emissions data.

Comments on Section 4.0 HAPs of Concern

The statement that "none of the emissions of HAPs from wood-fired boilers would exceed a level of concern" **fails to acknowledge all of the emissions data contained in the NCASI report including the worst case emissions data contained in the NCASI report**. This issue is discussed in detail in the NHDES Air Resources Division memo dated April 22, 1998 (See attached memo). It is highly inappropriate to ignore this data and only examine emissions data from units that have either electrostatic precipitators or fabric filters, especially since no recommendation as to the what **type** of particulate matter control (multiclone, ESP, fabric filter) constitutes MACT floor for particulate matter emissions. This statement also fails to acknowledge the emissions data referred to in EPA's draft report on "The Inventory of Sources of Dioxin in the United States" and the conclusions contained in the NCASI report.

Further this statement fails to recognize the documented impact of fuel moisture content, saltwater, additives, etc. on the level of dioxins emitted by wood-fired boilers. (This information is readily available from EPA's website.) In sum, this statement fails to accurately characterize currently available emissions data and the results of the triage analysis (see matrix attached to NHDES -Air Resources 4/22/98 memo).

EPA's statement in its 1995 report is not consistent with the statement contained in EPA's draft report on "The Inventory of Sources of Dioxin in the United States" and also not consistent with the emission data submitted by Mike Soots which documents lower emission rates for dry furniture wood when compared with the NCASI emissions data for green timber residues.

The statement that organic emissions are generally not increased from combustion of "treated" wood is also inconsistent with the data contained in EPA's draft report on "The Inventory of Sources of Dioxin in the United States."

The statement that emissions of chlorinated organic compounds are extremely low fails to acknowledge that dioxin emissions vary dramatically with the chloride content of the wood as documented in EPA's draft report on "The Inventory of Sources of Dioxin in the United States."

Comments on Section 6.0 MACT Floor

The MACT Floor statement is both vague and premature. The statement that MACT Floor is particulate matter control is not specific enough. If the Subgroup was not able to analyze the available data because the "data is currently not in a form that is useful.", then the Subgroup should not be reaching conclusions on the MACT Floor.

Summary

This paper fails to acknowledge all available emissions data and "cherry picks" the data that seems to support its conclusions while ignoring other data even when that data is found in reports referenced by the Subgroup (for example the NCASI report). This paper is inconsistent throughout because it makes statements that available data has not yet been reviewed, while at the same time reaching conclusions on the MACT Floor (presumably for all biomass boilers), even though data provided to the subgroup by members of the Subgroup indicates that HAPs emissions vary widely with the type of biomass being combusted.

Note: These comments are marked draft because they have not been reviewed by and do not include all issues and concerns raised at the last Boiler Workgroup by Boiler Workgroup members Robert Palzer, David Marrack, or Alex Johnson.

cc: Robert Palzer, David Marrack, Alex Johnson a:\biomass

STATE OF NEW HAMPSHIRE
Department of Environmental Services
Air Resources Division
Inter-Office Communication

FROM: **Andrew M. Bodnarik**
ICCR Boiler Workgroup Member
ICCR Wood HAPs of Interest Subgroup Member

To: **Jim Eddinger, ICCR Boiler Workgroup Co-Chair**
Jim Stumbar, ICCR Boiler Workgroup Co-Chair
Frank Ferraro, Boiler Workgroup Member

Date: **September 1, 1998**

RE: **DRAFT Comments on "Rationale for the Subcategory Definition for Biomass-fired Boilers under Section 112 of the Clean Air Act**" (Version e-mailed to ICCR Boiler Workgroup, August 27, 1998)

General Comments

The title of the paper still does not accurately reflect its contents, since it contains statements on several other issues beyond the issue of defining biomass boilers as a subcategory such as: HAPs of Concern for the "Wood subcategory, Pollution Prevention for Wood & Biomass boilers, and MACT floor for "biomass-fired" (including "clean" wood) boilers. This problem is **still** compounded by the fact that **the introduction to the paper repeatedly refers to a subcategory definition without explaining to the reader that the actual subcategory definition can be found in the "subcategory template" attached to the narrative**. While this type of reference is probably not required for members of the ICCR Boiler Work Group or the Wood Subgroup, it should be included to assist the members of the ICCR Coordinating Committee and other readers of the paper. **The new paragraphs added to this document in the Background and Subcategory Characterization sections do not fix this problem because they still do not give a direct definition of the term "biomass-fired boiler".**

The statement on materials combusted implies that alcohol fuels derived from wood and wood products should be included under the definition of biomass. This **still seems inconsistent** since fermentation tank bottoms are excluded. **The term "alcohol fuels" is still too broad** and would seemingly allow any fuel containing any amount of alcohol to be classified as biomass if the alcohol portion resulted from biomass. **No basis is given for the subcategory bounds.** While recognizing that this paper and the subcategory template are works in progress some concept must have been used as a basis for this subcategory. **The underlying concept(s) for selecting the subcategory bounds must be clearly stated.**

The subcategory template was not included with this version of the document and should be checked to see if the following problems were addressed:

1) The Combustion Device description in the subcategory template fails to recognize the combustor types described in the narrative, i.e.: cell burners, Dutch ovens, various grate burning systems (spreader stoker boilers with either fixed or traveling grates, underfeed stoker boilers, and inclined grates), and suspension burners. These combustor types should be included in the subcategory template;

2) The subcategory template uses the term "good particulate control" without explaining how "good" is distinguished from "poor". Therefore this term is too vague. If good particulate control means an electrostatic precipitator or a fabric filter then this should be clearly stated;

3) The statement in the subcategory template under the section on Floor Level of Control that: "Clearly, no additional pollution control equipment is required for control of HAPs metals beyond particulate matter control" is too vague since there is a broad range of particulate matter controls which have variable control efficiencies. This statement is even weaker than the term good particulate control;

4) The statement in the subcategory template under the section on Floor Level of Control that: "Likewise, any organic emissions are very low and can be controlled by attention to maintaining good combustion," is at best premature. Later in the Status of Data Collection and Analysis section a statement is made that analysis of the currently available emissions limitation data was not completed by the subgroup to determine a MACT floor for organic HAPs because the data "is currently not in a form that is useful. If you have not completed the analysis of the available data then do not reach premature conclusions. In addition, this statement also fails to recognize that organic HAP emissions vary with the type of biomass combusted as well as with the type of combustor. In essence, conclusions are being made prior analyzing the currently available emissions data and other data needed to determine the Floor Level of Control; and

5) The section on Floor Level of Control also fails to acknowledge the Boiler Workgroups recommendation for further testing. This stack test information will also be a useful supplement to currently available emissions data.

Comments on Section 2.0 BACKGROUND

The definition of solid waste is crucial to this subcategory definition because it will serve to limit the definition of both "clean wood" and "biomass". In fact the terms "biomass" and "clean wood" need to be carefully reviewed to insure that they are not too broadly defined.

Comments on Section 4.0 HAPs of Interest

The statement that "none of the emissions of HAPs from wood-fired boilers would exceed a level of concern" **still fails to acknowledge all of the emissions data contained in the NCASI report including the worst case emissions data contained in the NCASI report**. This issue is discussed in detail in the NHDES Air Resources Division memo dated April 22, 1998 (See attached memo). **It is still highly inappropriate to ignore this data and only examine emissions data from units that have either electrostatic precipitators or fabric filters, especially since no specific recommendation as to**

the what type of particulate matter control (i.e., multi-clone, ESP, fabric filter) constitutes MACT floor for particulate matter emissions is made. This statement still fails to acknowledge the emissions data referred to in EPA's draft report on "The Inventory of Sources of Dioxin in the United States" and the conclusions contained in the NCASI report. Further this statement still fails to recognize the documented impact of fuel moisture content, saltwater, additives, etc. on the level of dioxins emitted by wood-fired boilers. (This information is readily available from EPA's website.) In sum, this statement still fails to accurately characterize all currently available emissions data and the results of the triage analysis (see matrix attached to NHDES -Air Resources 4/22/98 memo).

EPA's statement in its 1996 report is not consistent with the statement contained in EPA's draft report on "The Inventory of Sources of Dioxin in the United States" and also not consistent with the emission data submitted by Mike Soots which documents lower emission rates for dry furniture wood when compared with the NCASI emissions data for green timber residues.

The statement that organic emissions are generally not increased from combustion of "treated" wood is also inconsistent with the data contained in EPA's draft report on "The Inventory of Sources of Dioxin in the United States."

The statement that emissions of chlorinated organic compounds are extremely low still fails to acknowledge that dioxin emissions vary dramatically with the chloride content of the wood as documented in EPA's draft report on "The Inventory of Sources of Dioxin in the United States."

Finally, it should be obvious by now that EPA needs to review and revise the statements in its 1996 report in light of the new data presented to EPA during the ICCR process and furthermore that EPA needs to further examine the NCASI data since EPA itself has questions about the reliability of that data.

Comments on Section 6.0 MACT Floor

The MACT Floor statement is still both vague and premature. The statement that MACT Floor is particulate matter control is not specific enough. If the Subgroup was not able to analyze the available data because the "data is currently not in a form that is useful.", then the Subgroup should not be reaching conclusions on the MACT Floor.

Summary

This paper still fails to acknowledge all available emissions data and "cherry picks" the data that seems to support its conclusions while ignoring other data even when that data is found in reports referenced by the Subgroup (for example the NCASI report). This paper is inconsistent throughout because it makes statements that data contained in the ICCR Boiler Inventory is not sufficiently detailed, while at the same time reaching conclusions on the MACT Floor (presumably for all biomass boilers), even though data provided to the subgroup by members of the Subgroup indicates that HAPs emissions vary widely with the type of biomass being combusted.

Note: These comments are marked draft because they have not been reviewed by and do not

include all issues and concerns raised at the last Boiler Workgroup by Boiler Workgroup members Robert Palzer, David Marrack, or Alex Johnson.

cc: Robert Palzer, David Marrack, Alex Johnson

a:\biomass3.wpd

Rationale for Non-Fossil Boiler Subcategories

Non-Fossil Boilers
Rationale for Subcategories and Model Boilers
Strawperson Analysis

SUBCATEGORIES

The non-fossil boiler population is best classified by:

1) the three physical states of matter (gas, liquid and solid);
2) type of solid fuel boilers (stoker, pulverizer and other); and
3) fuel types or classifications.

Within the solid fuel category, the type of boiler and its associated fuel delivery system has an impact on emissions. This is because of the combustion process involved and the control device normally associated with that type of boiler. Fuel feeds for stoker boilers have varying particle sizes generated by chopping or shredding processes. Pulverizer boilers utilize dust-like feeds, hence a very different combustion process than stoker boilers. The remaining solid fuel boilers such as fluidized bed, Dutch oven, etc. make up the balance of the population.

The third division utilizes unique characteristics of the material (mostly solids) to place it in a subcategory representing a large population (e.g., low or high Btu gas, bagasse, etc.) or potential Section 129 materials (e.g., municipal solid waste, waste oil, etc.).

PERCENT OF MAJORITY NON-FOSSIL FUEL FIRED

There is normally always one non-fossil material which dominates other materials and fuels when being combusted on a mass feed basis. The following conclusions are made when analyzing three such breakdowns: >50%, >70% and >90%.

1. Number of boilers in the gaseous subcategories decreases as progress from 50% to 90% mass fraction of gas.

2. Number of boilers in the more "non-descriptive" subcategories increases as progress from 50% to 90% mass fractions. These subcategories include "Section 112 wood and other non-fossil," "Section 112 mixed feeds" and potential "Section 129 mixed feeds."

The subgroup used a >70% mass feed because it allows the subject material a clear dominance in equipment configuration, control devices or emissions as compared to the 50% rate. Also, the >70% cut keeps the "non-descriptive" subcategories from containing most of the non-fossil boiler population.

SECTION 129 DE MINIMUS

Many non-fossil boilers burn a small fraction of presumably Section 129 material. The emissions impact of burning small fractions of these Section 129 materials with the balance non-fossil and/or fossil fuels is unknown due to lack of data. Determining this impact is one goal in the Boiler Work Group Phase 1 test plan.

The following table summarizes the Section 129 de minimus impact on non-fossil boiler population based on >70% non-fossil fuel input.[2]

	No De Minimus for Potential Section 129 Materials			5% De Minimus for Potential Section 129 Materials		
		Number of Boilers			Number of Boilers	
	Number of Boilers	With Controls	Percent Controlled	Number of Boilers	with Controls	Percent Controlled
Section 112 Boilers	495	339	68%	742	543	73%
Section 129 Boilers	508	427	84%	261	223	85%
Total	1003			1003		

This data reflects the obvious that as a de minimus is imposed for potential Section 129 materials, the boiler population shifts from Section 129 to Section 112. However, it also reveals two other facts:

1. A large fraction of boilers burns a small fraction of potential Section 129 material. Actually, 247 boilers (742-495 = 247) or $\frac{247}{508}=49\%$ of the boilers burning potential Section 129 materials burn up to 5% of that material on an annual basis.

2. A large percentage of these boilers burning up to 5% of potential Section 129 material are equipped with controls. Of the 247 boilers, 204 boilers (543-339 = 204), or 87%, have controls.

Resolution on use or how much of a de minimus is used is best addressed in The Incinerator Regulatory Alternative Paper (RAP). Non-Fossil subgroup members were in favor of a de minimus with 5% as a possible level (reference Non-Fossil Fuel Subgroup meeting minutes of June 9 - 10, 1998). Therefore the boiler population data used in the Non-Fossil Subcategory rationale is based on a 5% de minimus of potential Section 129 materials.

Additional Sub-Category Adjustments

Boilers burning over 70% of a non-fossil gas were merged into one subcategory in June 1998. These subcategories are “Low Btu Gas”, “High Btu Gas” and “Fossil or non-fossil gases with other gases”. Primary reason is that the control common to these boilers is combustion controls. Only four out of 162 boilers utilized particulate control which is presumed due to co-firing a solid material. Additionally, fuel compositions are not expected to create extreme emission variations dictating separate subcategories.

Non-fossil gas materials include coke oven gas, blast furnace gas, landfill gas and miscellaneous process gas streams.

There are approximately 300 boilers burning digester gas that were not accounted for in version 2 of the ICCR Survey database (SIC codes 4952 and possibly 4953). These boilers should~~could~~ be treated as a separate subcategory ~~included in the Non-fossil subcategory~~ or potentially merged with the Fossil gas subcategory due to combustion and HAPs similarities of digester and natural gases.

Three subcategories dealing with potential Section 129 solid materials were merged together as Section 129 mixed feed solids. These subcategories were Municipal Solid Waste (MSW), Tires and Section 129 mixed feed. Of the latter, boilers burning >70% of potential Section 129 solids were merged into Section 129 mixed feed solids. A small fraction of boilers burning >70% of potential Section 129 liquids merged into the Section 129 mixed feed liquids subgroup described below. The rationale for the solid fuel merge follows the general subgroup philosophy to group gases, liquids and solids. Additionally, it combines a relatively small population (MSW and tire burning units) with a much larger population, although some

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[2] Compiled from Tables IV. C-7, 8, 9 and 10 of April 20, 1998 Non-Fossil Subgroup data.

stakeholder(s) question whether tires should be a section 129 material.

Waste oil boilers are merged with potential Section 129 mixed feed liquids in accordance with the previously mentioned philosophy. This only applies to waste oil materials strictly classified as non-hazardous waste material and not to waste oil exempted from that classification.

Bio-mass and bagasse boilers have been combined together, then further merged with specific wood product boilers into a subgroup called Bio-mass (reference July 30, 1998 Boiler Work Group meeting minutes). This action groups solid materials with the unique characteristic of being agricultural based. Materials contaminated with coatings, construction debris, sewage or paper mill sludges, etc. are excluded.

MODEL BOILERS

Objectives in model boiler development are to define boilers representing the actual population with variances in capital and operating costs. A goal is to define at least 80% of the population with model boilers.

The non-fossil subgroup approach is to describe the population with essentially four combustor types (fluidized bed, stoker, suspension and other) divided into four to five capacities. Within each of these divisions, specific model boilers are defined by material burned, since both capital and operating costs vary greatly among solid, liquid and gaseous fuels. Also, there can be significant differences among the type of solid due to varying water content, feed handling and processing and control devices.

There is insignificant impact on boiler modeling from boilers burning low quantities of materials. Therefore no modeling is provided for boilers burning less than 5% of a particular material.

Additionally, cleaner fuel materials are combined with less clean material to obtain further reduction in model boilers. Therefore gaseous material (high or low Btu gases) or fuel oils were combined with solid fuel boilers (e.g., wood or coal).

Non-Fossil Subgroup
Model Boiler Summary

Boiler Type	Capacity (MM Btu/hr)	June 1998		August 1998	
		Number of Model Boilers	Number of Actual Boilers	Number of Model Boilers	Number of Actual Boilers
Fluidized Bed	10-100	1	1	1	1
	100-250	1	1	1	1
	>250	5	13	4	13
	Unknown	6	9	5	9
Stoker	0-10	5	9	5	9
	10-100	23	60	21	71
	100-250	18	56	15	56
	>250	32	124	19	124
	Unknown	31	152	19	124
Suspension	0-10	3	4	3	4
	10-100	16	42	10	42
	100-250	12	41	6	41
	>250	23	64	10	64
	Unknown	13	35	5	35
Other	0-10	13	29	7	29
	10-100	19	88	14	87
	100-250	13	50	7	50
	>250	13	38	6	38
	Unknown	17	109	11	82
	Total	**264**	**925**	**169**	**880**

Percent of Boilers covered by Model Boilers: 92% 88%

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